Institut für
Angewandte Mathematik

Leibniz
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Oberseminar
Analysis und Theoretische Physik

Jun.-Prof. Dr. Amru Hussein
(RPTU Kaiserslautern-Landau)

Maximal L^p-regularity and H^∞-calculus for block operator matrices and applications

Many coupled evolution equations can be described via 2 x 2-block operator matrices of the form $A = \begin{bmatrix} A & B \\ C & D \end{bmatrix}$ in a product space X = X1 x X2 with possibly unbounded entries. Here, the case of diagonally dominant block operator matrices is considered, that is, the case where the full operator *A* can be seen as a relatively bounded perturbation of its diagonal part though with possibly large relative bound. For such operators the properties of sectoriality, R-sectoriality and the boundedness of the H^∞-calculus are studied, and for these properties perturbation results for possibly large but structured perturbations are derived. Thereby, the time dependent parabolic problem associated with *A* can be analyzed in maximal L^p_t -regularity spaces, and this is illustrated by a number of applications such as different theories for liquid crystals, an artificial Stokes system, strongly damped wave and plate equations, and a Keller-Segel model. The approach developed here is based in spirit on a combination of the theory by Kalton, Kunstmann and Weis (Perturbation and interpolation theorems for the H^∞-calculus with applications to differential operators. Math. Ann., 336(4):74-801, 2006) relating R-sectoriality and the boundedness of the H^∞-calculus with concepts for diagonally dominant block operator matrices pioneered by Nagel (Towards a "matrix theory" for unbounded operator matrices. Math. Z., 201(1):57-68, 1989) for C0-semigroups.
The presentation is based on a joint work with Antonio Agresti, see https://doi.org/10.1016/j.jfa.2023.110146.

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Veranstalter: Prof. Dr. Wolfram Bauer, Prof. Dr. Joachim Escher, Prof. Dr. Johannes Lankeit, Prof. Dr. Elmar Schrohe, Prof. Dr. Alexander Strohmaier, Prof. Dr. Christoph Walker, Dr. Alden Waters